The Role of Automatic Conditioned Reinforcement and Automatic Conditioned Punishment in Infant Vocal Behavior

Rick A. Smith

Western Michigan University

Follow this and additional works at: http://scholarworks.wmich.edu/masters_theses

Part of the Experimental Analysis of Behavior Commons

Recommended Citation
http://scholarworks.wmich.edu/masters_theses/1656

This Masters Thesis—Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Master’s Theses by an authorized administrator of ScholarWorks at WMU. For more information, please contact maira.bundza@wmich.edu.
THE ROLE OF AUTOMATIC CONDITIONED REINFORCEMENT AND AUTOMATIC CONDITIONED PUNISHMENT IN INFANT VOCAL BEHAVIOR

Rick A. Smith, M.A.
Western Michigan University, 1983

Two female children, aged 11 and 14 months, were exposed to a procedure in which an experimenter-emitted vocal response was paired with a reinforcing stimulus (positive condition), a neutral stimulus (neutral condition), or a mild aversive stimulus (negative condition). An AB design was utilized to examine the effects of the pairing procedure on the subjects' vocal responding. Sessions were conducted in each subject's home. Only one subject was exposed to the pairing with a neutral (control) stimulus, and with the mild aversive verbal stimulus. Responding during the post-pairing period remained constant in the neutral condition, but was markedly reduced in the negative condition. A gradual increase in the frequency of non-paired vocal responses was seen after a vocal behavior-free period. The pairing procedure altered the type, and rate of vocal responding. In 75% of the sessions the paired response increased in frequency after pairing with respect to baseline levels. These data provide experimental evidence for the existence of automatic conditioned reinforcement and punishment, both of which are integral components of Skinner's analysis of behavior.
ACKNOWLEDGEMENTS

The author wishes to express sincere gratitude to the following people for their assistance in preparing this manuscript: Dr. Jack Michael for the many hours spent clarifying the topic of this paper; Dr. Paul Montjoy and Dr. Norman Peterson, committee members; Dr. Mark Sundberg and Dr. Margaret Petersen for their assistance in designing the procedure, and Della M. Gustman for editing and typing.

I am deeply indebted to my parents, Ronald M. Smith and Norma J. Smith for the many years spent preparing me for undergraduate and graduate studies.

Special thanks to my wife, Denise A. Smith, for her reliability checks, editing and typing the manuscript, and for applying the contingencies to my behavior.

Rick A. Smith
SMITH, RICK A.

THE ROLE OF AUTOMATIC CONDITIONED REINFORCEMENT AND AUTOMATIC CONDITIONED PUNISHMENT IN INFANT VOCAL BEHAVIOR

WESTERN MICHIGAN UNIVERSITY M.A. 1983

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark ✓.

1. Glossy photographs or pages
2. Colored illustrations, paper or print
3. Photographs with dark background
4. Illustrations are poor copy
5. Pages with black marks, not original copy ✓
6. Print shows through as there is text on both sides of page
7. Indistinct, broken or small print on several pages ✓
8. Print exceeds margin requirements
9. Tightly bound copy with print lost in spine
10. Computer printout pages with indistinct print
11. Page(s) _______ lacking when material received, and not available from school or author.
12. Page(s) _______ seem to be missing in numbering only as text follows.
13. Two pages numbered ________, Text follows.
14. Curling and wrinkled pages
15. Other

University Microfilms International

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>iv</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>METHOD</td>
<td>12</td>
</tr>
<tr>
<td>Subjects</td>
<td>12</td>
</tr>
<tr>
<td>Setting</td>
<td>12</td>
</tr>
<tr>
<td>Procedure</td>
<td>12</td>
</tr>
<tr>
<td>Observation and Reliability</td>
<td>14</td>
</tr>
<tr>
<td>RESULTS</td>
<td>15</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>32</td>
</tr>
<tr>
<td>REFERENCE NOTES</td>
<td>37</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>38</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

1. Subject Number One, positive condition ............. p. 16
2. Subject Number One, positive condition ............. p. 16
3. Subject Number One, positive condition ............. p. 17
4. Subject Number Two, positive condition ............. p. 17
5. Subject Number One, positive condition ............. p. 18
6. Subject Number One, positive condition ............. p. 18
7. Subject Number One, positive condition ............. p. 19
8. Subject Number Two, positive condition ............. p. 19
9. Subject Number Two, positive condition ............. p. 20
10. Subject Number Two, positive condition ............. p. 20
11. Subject Number One, positive condition ............. p. 21
12. Subject Number One, positive condition ............. p. 21
13. Subject Number One, positive condition ............. p. 23
14. Subject Number One, positive condition ............. p. 23
15. Subject Number One, positive condition ............. p. 24
16. Subject Number Two, positive condition ............. p. 24
17. Subject Number One, neutral condition ............. p. 26
18. Subject Number One, neutral condition ............. p. 26
19. Subject Number One, negative condition ............. p. 28
20. Subject Number One, negative condition ............. p. 28
21. Subject Number One, negative condition ............. p. 29
INTRODUCTION

The role of consequences in an analysis of behavior is critical for a complete description of an event. Learning theorists argue that consequences are omnipresent and necessary for the establishment and maintainence of all behavior. Consequences are stimulus changes contingent upon behavior. Stimulus changes that increase the future probability of a response being emitted are reinforcers. Consequation that results in a lowered probability of future occurrence for a response is punishment. The "principles" of behavior were discovered in the laboratory working with experimental animals. These principles were expanded and eventually applied to human behavior. Working with the mentally retarded, Fuller (1949) was able to increase the frequency of a simple operant by consequating the behavior with a warm sugar-milk solution. This was one of the first systematic applications of behavioral techniques to human behavior. Today the application of the principles of behavior is the single most effective tool for the training and treatment of the mentally retarded.

The science of human behavior is not limited to the retarded. The behavior of "normal" humans can be effectively analyzed, revealing the controlling variables responsible for the emission of each response. The retarded population has long been the subject of experimentation due to several factors. The institutionalized individual's environment was easily controlled; many of the behaviors exhibited by the mentally retarded precluded community living. If these behaviors could be
modified or controlled the individual could move away from the institution and become a productive member in society. These studies generally concentrated on decreasing maladaptive behaviors and increasing self-care skills. These beginning experiments provided a basis on which to expand to the normal population.

Behaviorism quickly expanded in education and industry, due in part to the ability of the experimenters to control the environmental conditions. These studies concentrated on increasing productivity, retention of skills, keeping subjects on task, etc. The behaviors were easily identifiable, easily measured, and easily controlled by positive reinforcement. The literature is replete with studies providing evidence that positive reinforcement is effective. But, human beings exhibit another type of behavior, behavior that is not always easily identifiable, measurable, or controllable. It is verbal behavior.

Skinner, in his book *Verbal Behavior* (1957), analyzed verbal behavior without appealing to any new principles of behavior. Skinner defines verbal behavior as "behavior reinforced through the mediation of others" (p. 14). He later refines the definition by adding "and that the listener responds in ways which have been conditioned precisely in order to reinforce the behavior of the speaker" (p. 225). By placing the "meaning" of verbal behavior outside the person, rather than attributing "meaning" to events taking place inside, the factors responsible for the emission and content of a verbal episode can be examined. A person will say "hot dog please" when requesting action from a vendor because he has been reinforced in the past for similar responses to similar situations. Skinner (1957) states "It is usually asserted that we can see meaning or
purpose in behavior and should not omit it from our account. But meaning is not a property of behavior as such, but of the conditions under which behavior occurs" (p. 13). As we examine verbal behavior and its causes (or "meanings"), it becomes apparent that Skinner's analysis has much to offer in the way of explanation. A person says "hot dog" and is given a hot dog under appropriate stimulus conditions. A young child expresses derogatory statements toward his parents and is promptly punished, resulting in a lowered probability of expressing himself in that way in the future. These examples are easily analyzed in behavioral terms.

But what of verbal behavior that is not so easily analyzed? How can we explain a person singing to himself, a southerner's distinctive accent, or a child babbling?

The fields of psycholinguistics and cognitive psychology have attempted to "explain" these behaviors in terms of causes originating within the human organism. That which makes us different from lower organisms (mind, soul, intelligence, etc.) is the origin of ideas, thought, grammatical structure, etc. Researchers in these fields argue that grammatical processes are not learned, but rather, are due to something else, a "deep structure" within the organism. Some have provided research as a basis for their contention that reinforcement theory is incomplete, if not inaccurate (deVilliers and deVilliers, 1979, Piaget 1951). A typical study of this type might involve recording parents' interactions with their children for extended periods of time. Data collected would reveal that children begin uttering grammatically correct sentences despite the lack of any obvious external reinforcement.
for doing so. Thus, they argue, grammatical processes are not learned but are inherent in the organism.

In his review of Skinner (Chomsky, 1959), Chomsky stated "The phrase 'X is reinforced by Y (stimulus, state of affairs, event, etc.)' is being used as a cover terra for 'X wants Y', 'X likes Y', 'X wishes Y were the case', etc." (p. 26). Neisser (1976), echoed Chomsky's claims and added, "A generation ago, a book like this one would have needed at least a chapter of self-defense against the behaviorist position. Today, happily, the climate of opinion has changed and little or no defense is necessary" (p. 5). He later states that behaviorists themselves are inventing hypothetical mechanisms.

Brown and Hanlan (1969) examined the records of several children and their parents for familiar expressions of approval and disapproval contingent upon the child's speech. Expressions such as "that's right" or "very good" or "that's wrong" or "no" were quite rare in the records, but each occurrence was listed together with the child's utterance it followed. The researchers then contrasted the population of utterances followed by signs of approval with that followed by signs of disapproval to determine whether the latter was less syntactically correct than the former. They concluded, "In neither case is there a shred of evidence that approval and disapproval are contingent upon syntactic correctness. Instead, the parents attended to the "truth" value of the children's utterances rather than their grammaticality" (pp. 206-208).

If we accept that this study adequately controlled all extraneous variables and that these parents are typical of most in that they do
not overtly reinforce or punish a child's verbal behavior with respect to syntactical form, but rather in terms of its "truth or falseness", how can we explain the origin of correct syntactical form?

There are other examples. Peterson (1980) noted "an individual is not, in any obvious sense, reinforced for a particular accent of intonation, and yet sounding like a New Yorker is assumed for someone raised in New York." What accounts for these intonations which seem to be highly correlated with geographic location? As noted previously in Brown and Hanlan's study it appears that only the "correctness" of utterances is addressed by parents. It seems unlikely that intonation or accent are reinforced or punished in any systematic fashion.

Are behavior analysts able to provide an explanation for this type of behavior, or are we compelled to accept explanations based on hypothetical constructs? Skinner (1957) suggests an alternative. Incorporation of the concept of automatic conditioned reinforcement as the controlling variable for behaviors which lack a history of easily observed environmental consequences makes it unnecessary to appeal to hypothetical constructs. A response produce may acquire reinforcing value through its association with a conditioned or unconditioned reinforcer. This is stimulus-stimulus pairing. In stimulus-stimulus learning a neutral stimulus acquires reinforcing properties due to its association with other reinforcing stimuli. Any response which produces the conditioned stimulus will be automatically reinforced. An example of this type of conditioning process occurs when the mother's verbal behavior becomes reinforcing to the child due to its association with unconditioned reinforcement (food, warmth, etc.). The mother typically does not
systematically reinforce the child's vocalizing, rather the child's reproduction of some aspects of her speech is automatically reinforcing in that "it sounds good" to sound like one's mother. We must assume, of course, that the differences between the sound of the adult's phoneme and the child's reproduction are similar, although not exactly the same. For vowel sounds it is reasonable to assume that the higher the pitch of the adults sound the more it resembles the child's. The tonation does not appear as critical for consonant sounds.

Bijou and Baer (1965), detail this process while describing the onset and beginnings of verbal behavior. "The normal baby hears his own vocalization, of course. Such sounds are mildly reinforcing in that they function like other ecological reinforcers. They gain additional reinforcing effectiveness, however, if they are similar to the mother's vocalizations (generalization). Hence, one might say that the sound of the baby's vocalizations "automatically" strengthens the vocalizations themselves. As a result, the infant's vocal responses become both stronger and differentiated into those which more and more closely produce sounds like the mother's speech, since vocal responses which resemble the mother's will be strengthened more than vocal responses which do not." (p. 160).

This process has been described in detail by Osgood (1953). He has presented a set of labels for describing stages in this time of development. His characterization of the vocal sounds produced during the first few months of life emphasizes their random nature, noting that the vocal apparatus "is a muscular system, activity here partakes of the gross, mass activity of the total organism. Just as arms and legs are randomly moved about, so the jaws, lips, tongue, and vocal cords are
randomly exercised and when air happens to be pushed through the oral
cavity, varying patterns of sound are produced." He goes on, "...within
the data for the first two months of life may be found all of the speech
sounds that the human vocal system can produce, including French vowels
and trills, German umlaut and guttural sounds, and many that are only
describable in phonetic symbols. This is in flat contradiction to the
notion that the infant gradually "becomes capable" of making various
sounds."(p. 684)

Skinner (1957) states, "Reinforcing sounds in a child's envi­
ronment provides for automatic reinforcement of vocal forms. Such
sounds need not be verbal; the child is reinforced automatically when
he duplicates the sounds of airplanes, streetcars, automobiles, vacuum
cleaners, birds, cats, dogs, and so on. But among the sounds which
become important are the verbal responses of his parents and others.
The child can then reinforce himself automatically for the execution
of vocal patterns which are later to become part of his verbal behavior.
At this stage the child resembles a parrot, which is also reinforced
when its vocal productions match something heard in the environment."  
(p. 164)

It would seem then that behavior analysts are able to avoid the
use of hypothetical constructs altogether. The concept of automatic
conditioned reinforcement allows us to analyze these aspects of verbal
behavior without appealing to internal functions. The control or "meaning"
remains in the external environment.

Some of the theorists that have attacked the behavioral position
have concentrated specifically upon automatic reinforcement and cite
its supposed weaknesses. First, some sounds that are fairly frequent at the back of the mouth during early babbling like (g), (k), and initial (h) sounds are quite infrequent in later babbling and in children's early words (Leopold, 1953; Winitz and Irwin, 1958). Second, deVilliers and deVilliers (1979) have stated that while imitation of adult sounds may well be an important process in the learning of first words, the behaviorist theory has nothing to say about any consistent order in which children might acquire the different sounds of the language (p. 36). Third, that automatic conditioned reinforcement itself is a hypothetical mechanism, which is precisely the type of explanation that behaviorists typically avoid (Neisser, 1976).

With respect to the first "weakness", a gravitational factor may be relevant. It is widely known in the field of speech pathology that while the infant is lying on his or her back the sounds made at the back of the mouth appear to be more easily produced than sounds made at the front of the mouth (Morgan Note 4 and Carmack Note 5). This may account for the apparent decrease in frequency of sounds like (g), (k), and initial (h). The children in the Leopold (1953) and Winitz and Irwin (1958) studies were very young when first observed and were probably unable to sit upright. The gravitational effect upon their vocal musculature enabled them to emit the typically more difficult sounds "relatively frequently". The comparison observations were made when the children were older and able to sit upright. Their upright posture during the observation would account for the infrequent emission of sounds produced at the back of the mouth.

The behavioral explanation of verbal development does address a
consistent order of verbal acquisition. However, deVilliers and deVilliers (1979) state that behaviorists ignore this aspect of verbal development. Possibly true, but it is not difficult to provide a behavioral treatment. Any consistent order in verbal acquisition is probably due to a combination of the following factors: the relative ease of emission, the frequency of hearing the sounds, the pairing of the sounds with reinforcing events resulting in the sounds acquiring automatic reinforcing properties, and direct reinforcement of the sounds.

The third "weakness" is easily understood. The science of human behavior has from the beginning looked to the environment for the "causes" of behavior. The conditioning process which establishes a response product as an automatic reinforcer releases the operation from the immediate external environment. The fact that the response is later emitted and is reinforced without the "typical" events occurring in the environment might seem to support the notion of a hypothetical construct, but when one considers the entire process and the link to the environment, the concept of automatic reinforcement is just as objective as any reinforcement concept. The experimental validation of the existence of automatic reinforcement, however, is at best quite limited. Mowrer (1960), worked with mynah birds and discovered the importance of automatic reinforcement in the development of their vocal behavior. He stated:

In order for a bird to learn to make a particular word sound, that sound has first to be heard, repeatedly, in a pleasant, agreeable context. Varied evidence indicates that if a sound such as "Hello" is uttered as the trainer comes into the presence of the bird after an absence, or if the sound is repeated as the trainer gives the bird food and water, scratches its head or neck or
amuses or comforts the bird in some other way, the bird will sooner or later start using the word, both in the absence of and in the presence of the trainer, as a means of securing "services" which the trainer can provide. (p. 73)

Mowrer utilized a two-factor theory to explain this phenomenon. Basically, the theory suggests two types of approach and avoidance. If an independent stimulus arouses "fear", flight is likely to follow; stimuli paired with those that arouse "fear" produce inhibition (i.e., automatic punishment). And, if a particular stimulus arouses "hope", stimuli paired with it will produce response facilitation (i.e., automatic reinforcement). We need not rely upon such hypothetical constructs as "hope" and "fear", however, the notions which Mowrer described are easily applied to a behavioral account of verbal acquisition.

Sundberg (Note 2), utilized a simple experimental design to determine the effects of automatic reinforcement on the verbal behavior of a three year old visually impaired male. The subject was a student in a multihandicap school program. By pairing a new vocal topography with tactile stimulation Sundberg was able to establish the vocal topography as a response in the boy's repertoire.

In summary, although Skinner has not analyzed automatic reinforcement in any systematic fashion, he incorporates the concept many times in this theoretical analysis of verbal behavior. Empirical evidence for the existence of automatic conditioned reinforcement and its effect upon verbal behavior, especially the onset of infant verbal behavior is limited to Sundberg's study.

The present study was designed to replicate Sundberg's work with normal children. Individual sessions with two subjects in an AB design
were utilized to discern resultant effects upon infant vocal behavior.

Theoretically, establishing a neutral stimulus as an automatic punisher is identical to establishing a neutral stimulus as an automatic reinforcer with one exception: conditioned or unconditioned punishment rather than positive reinforcement is paired with the neutral stimulus. For example, an infant may be bumped, scratched, etc. by the mother while she is speaking to the child. It is possible that respondent conditioning may occur between the negative stimulation and the vocal stimulation. This would undoubtedly be quite weak due to the following reasons: 1) the low frequency of pairing, 2) the reinforcing value that the mother's vocalization has acquired due to its association with positive stimuli in the past, and 3) the comfort that the child would probably receive after any such accident, thus strengthening the reinforcing aspects of the mother's vocalizations. Despite the weak effect upon behavior it may play an important role in the development of infant vocal behavior. For this reason it was included in this study with one subject.
METHOD

Subjects

Two females, ages 11 months and 14 months served as the subjects of this experiment. The children appeared to be normal in all aspects of development. The children were chosen for the study on the basis of availability and lack of escape responses during the study that many one year old children exhibit, such as crying and walking away.

Setting

The study was conducted in an area measuring approximately six feet by eight feet in one child's living room, and approximately 10 feet by 12 feet in the second child's bedroom.* Play materials consisted of books, plastic kitchen items, a watch, squeeze toys, a cassette tape player, and a data sheet. Sessions were run once per day for the first subject, and twice a day for the second subject.

Procedure

Positive Condition

Each session was an attempt to either establish a new topography or strengthen an existing topography being emitted at a low frequency.

Subject #2 was exposed to the positive condition only.

*The subject's mother was present during sessions with the second subject.
Pre-pairing

Each subject was placed in the play area with toys and allowed to play for several minutes. The experimenter, sitting next to the subject, began to continuously record all vocalizations emitted. A tape player also recorded the vocalizations and the two records were compared immediately after each session. Discrepancies resulted in a change in the experimenter-recorded data.

Pairing

The toys were removed and vocal responses were emitted by the experimenter while simultaneously presenting an established reinforcing stimulus (food, bottle, bubbles, tickles, party favors, etc.). The experimenter's responses were not contingent upon the subject's behavior, i.e., eye contact was not required. When the child emitted vocalizations during this period special care was taken not to accidentally reinforce them. Such reinforcement was prevented by initiating a fifteen second time-out period immediately after a vocal response. This was unnecessary after the first session with the first subject since the child characteristically did not emit vocalizations while others were speaking. The second subject did not emit vocalizations during this condition.

Post-postpairing

The toys were returned and the experimenter began recording all vocalizations made by the child. The conditions were identical to the pre-pairing condition.
Neutral Condition

All conditions were the same as in the positive condition except that the presentation of the reinforcing stimulus was omitted.

Negative Condition

All conditions were the same as in the positive condition except that a mild aversive stimulus ("bad girl") was paired with the experimenter-emitted responses.

Observation and Reliability

The experimenter conducted all primary observations, immediate data was collected in a notebook during each session. A cassette tape recorder recorded each session in its entirety. An assistant transcribed the tape after each session and the results were compared to the experimenter recorded data for two factors: (1) agreement of specific response topography, and (2) correct placement of recorded responses with respect to the 10-second time bins. Disagreement resulted in reviewing the tape recording until agreement was reached.
RESULTS

A total of 16 sessions occurred in four weeks with the first subject. Five sessions occurred in two weeks with the second subject. Data was collected in 10-second time bins. The cumulative number of responses are plotted across time.

A total of 16 positive condition sessions were presented (11 to Subject One and five to Subject Two). In Figures 1 - 12, it can be seen that the target response increased in frequency when compared to the pre-pairing condition. Figures 1 - 4 show an increase in frequency of a single response topography. Figures 5 - 12 show a combined effect where both the paired response topography and another response topography increased in frequency after the pairing condition. Figures 3, 10, 11, and 12 show a delayed increase in this over one minute.
Subject one: the sound "DA" was paired with food 14 times in 320 seconds (Session #4).

Subject one: the sound "DA" was paired with food 15 times in 320 seconds (Session #5).

TEN SECOND TIME BINS
Subject one; the sound "AH" was paired with a beverage 19 times in 400 seconds (Session #6).

Subject two; the sound "AH" was paired with soap bubbles 12 times in 160 seconds (Session #2).
Subject one; the sound "DA" was paired with soap bubbles 24 times in 190 seconds (Session #8).

Subject one; first pairing: the sound "DA" was paired with soap bubbles 20 times in 140 seconds. Second pairing: the sound "GA" was paired with soap bubbles 10 times in 90 seconds (Session #9).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Subject one; the sound "GA" was paired with soap bubbles 17 times in 90 seconds (Session #10).

Subject two; the sound "GA" was paired with soap bubbles 15 times in 100 seconds (Session #3).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Subject two; the sound "KA" was paired with soap bubbles 28 times in 150 seconds (Session #4).

Subject two; the sound "DA" was paired with soap bubbles 25 times in 120 seconds (Session #5).
Subject one; the sound "Ah" was paired with soap bubbles 8 times in 90 seconds (Session #12).

Subject one; the sound "Ah" was paired with a "roll-up blower" party favor 12 times in 70 seconds (Session #13).
Figures 13 - 16 reveal no significant increased frequency of the target response after the pairing condition. During a single session (Figure 13) a slight increase occurred in the frequency of the subject emitted response, however, the particular response topography had been exhibited at a relatively high rate during previous sessions. It would be expected then, that the response would be exhibited independent of the pairing session.
Subject one; the sound "GA" was paired with tactile stimulation 28 times in 160 seconds (Session #3).

Subject one; the sound "TA" was paired with tactile stimulation 16 times in 100 seconds (Session #7).

TEN SECOND TIME BINS
Subject one; the sound "BA" was paired with soap bubbles 18 times in 170 seconds (Session #11).

Subject two; the sound "LA" was paired with soap bubbles 18 times in 200 seconds (Session #1).

TEN SECOND TIME BINS
Two neutral condition sessions were presented to the first subject. No change in the paired response topography is seen for over three minutes in Figure 17, however, a brief increase in the frequency of the paired response topography can be seen in Figure 18. This may be due to the reinforcing qualities of experimentor's voice, established during the first 12 months of the child's life and the previous positive condition sessions.
Subject one; neutral condition, the sound "BA" was presented 63 times in 180 seconds (Session #1).

Subject one; neutral condition, the sound "DA" was presented 39 times in 160 seconds (Session #2).

TEN SECOND TIME BIN

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Three negative condition sessions were presented to subject number one. It can be seen in Figure 19 that all vocal responding ceased after the pairing session. The final two figures show that all vocal responding stopped for over one minute but several non-paired responses were emitted after the lapse.
Subject one; negative condition, the sound "MA" was paired with "bad girl" 5 times in 30 seconds (Session #14).

Subject one; negative condition, the sound "DA" was paired with "bad girl" 3 times in 10 seconds (Session #15).
Subject one; negative condition, the sound "MA" was paired with "bad girl" 6 times in 20 seconds (Session #16).
Figure 6 represents the only session with an additional pairing procedure and post pairing observation. The initial pairing produced an increase in the frequency of the response topography. However, when a second pairing of a different topography was presented a slight increase in the frequency of the newly paired topography was seen before all vocal responding ceased.

A change in frequency of emission of non-paired response topography after the pairing procedure seen in the three negative condition sessions (Figures 19 - 21) was also evident in the positive condition. In Figures 6, 7, 8, 9, 11, and 12, non-paired responses increased in frequency immediately, or after a short delay, in addition to the increase in frequency of the paired response. After the second pairing procedure in session six there was a cessation of all responding. A cessation of responding of a single response after the positive pairing can be seen in Figures 4 (DA), and 10 (AH), however, these may be a result of the increase in the frequency of the paired response topography. The increase in frequency of a non-paired response can be seen more clearly in Figures 13 (EH) and (AH), and 15 (AH), where the pairing procedure had no apparent effect upon the target response. The pairing procedure had no apparent effect on Subject One during the session represented in Figure 14. Figure 16 represented the second subject's first session. A complete cessation of vocal responding for over two minutes occurred after presentation of the pairing procedure.

In summary, after the pairing procedure, the target response increased in frequency in 12 of the 16 positive condition sessions presented to both subjects. In two of the four positive condition sessions in which
the target response did not increase a different response topography increased in frequency. Subject number two ceased all vocal responding after the pairing procedure in the first session (Figure 16). The attempt to pair a vocal topography which was not in subject number one's repertoire in an attempt to establish it as an automatically reinforced response was ineffective (Figure 15). Neutral condition pairing produced little if any effect on the behavior. The pairing of the target response with a mild aversive stimulus resulted in the elimination of the topography for the duration of the session. Response topographies which were not paired with the mild aversive stimulus were also affected to varying degrees during the three sessions.
DISCUSSION

The results of the present study support the original hypothesis that automatic reinforcement and automatic punishment are integral components in the acquisition of verbal behavior. The resultant changes in the frequencies of the target responses after the pairing procedure would seem to justify the statement that the independent variable had the expected effect upon the behavior.

These results are in concurrence with the findings of another researcher. Sundberg (Note 2), found that the pairings of words and tactile stimulation increased the frequency of subject emitted responses after the pairing session. The present study was intended to expand on Sundberg's results, both to replicate his results with normal children and to investigate the effects of automatic punishment. Experimental evidence for the existence of automatic reinforcement and automatic punishment is supportive of Skinner's (1957) analysis of verbal behavior. A functional analysis of verbal behavior has considerable merit for professionals attempting to establish the verbal repertoire of a non-verbal individual. Identification of the controlling variables of desired responses is essential to proper training and establishment of stimulus control. Training techniques based on this analysis could become common-place for parents training their children to speak.

It is important to distinguish behavior that is automatically reinforced from echoic behavior. Echoic behavior is defined as a vocal response controlled by an immediately prior auditory verbal stimulus which has point-to-point correspondence with the response. (Peterson 1978, p. 45). "The young child alone in the nursery may automatically
reinforce his own exploratory vocal behavior when he produces sounds which he has heard in the speech of others. The self-reinforcing property may be merely an interaction or some other idiosyncrasy of a given speaker or of speakers in general. A child whose mother often entertained at bridge imitated quite accurately the unintelligible noise of a room full of people talking volubly. The adult acquires intonational patterns which are automatically reinforcing because they are characteristic of, say, a person of prestige. Specific verbal forms arise from the same process. The small child often acquires verbal behavior in the form of commendation used by others to reinforce him: 'Tommy is a good boy,' just as the adult may boast of his own ability 'in order to hear himself praised.' The process is important in the automatic shaping up of standard forms of response. This is not echoic behavior, however, because a verbal stimulus of corresponding form does not immediately precede it." (Skinner 1957, p. 58). The distinction is important in the current study because it eliminates the possibility of the subjects' postpairing responding being under the control of an echoic stimulus.

The data presented here supports Skinner's analysis. Others have criticized the behavioral analysis of verbal behavior stating that a "major weakness" in Skinner's work is that while several experiments have shown that rewarding the child by social attention increases the frequency of babbling, none have shown that reinforcement can change the type of speech sounds produced by the child, (Rheingold, Gurwitz, and Ross, 1959; Weisburg, 1953; Todd and Palmer, 1968; Dodd, 1972; devVilliers and devVilliers, 1979). As seen in this study, sounds that
were not emitted during the baseline period were emitted by both subjects during the postpairing observation period. In the negative condition, the change in frequency of the vocal responses emitted after the pairing session appears to be the result of the pairing of the response topography and "bad girl" as emitted by the experimenter. Skinner (1957) states that "rejecting a response reduces the conditioned aversive stimulation generated by it and is reinforced because it does so." (p. 371) This may explain the complete cessation of all vocal responding immediately following the pairing procedure in the negative condition. It is also conceivable that the kinesthetic stimulation caused by the vocal emission of a particular sound becomes equivalent to the auditory stimulation caused by that sound. The pairing of the neutral stimuli with the mild aversive stimulus in the pairing procedure may have had the same effect as if the vocal musculature movement required to produce the sound were directly punished. This equivalency of the kinesthetic and auditory stimulation may result from the high frequency of pairing. The question then arises as to the cause of the gradual increase in the rate of responding during the postpairing observation after a period of time had elapsed. The responses emitted during postpairing observation were not paired with the mild aversive stimulus and were not affected as markedly as the target response. It is quite possible that a type of editing was occurring. Skinner (1957) states "If the subvocal test reveals simply that a response generates no conditioned aversive stimulation, the response is then released" (p. 380). The implications of these results are troubling. It appears that infant vocal behavior is quite susceptible to punishment. Subject number one, the only subject to participate in the negative condition
pairing, was under the control of the experimenter since birth. Her vocalizations were reinforced as often as possible. Vocal responses were required for gaining food, drink, being picked up, etc. Theoretically, vocal behavior should have been quite strong in her repertoire, however, a relatively small amount of automatic punishment completely disrupted her vocal responding. The fact that she was unaccustomed to punishment for vocal responding may account for the disruption. Unfortunately, many child-caretakers do not actively provide reinforcement for vocalizing. Some children may be punished for babbling at a very early age which could possibly result in a deficit of the vocal/verbal repertoire at a late age.

Automatic reinforcement is relevant to other behaviors. Skinner incorporates the concept in his analysis of thinking, problem solving, dynamic characteristics of verbal behavior, self management, textual behavior, and other behaviors when the reinforcement is removed from the immediate environment. Additional research is needed in these areas to determine the role of automatic conditioned reinforcement on acquisition and maintenance of the behaviors. Further work in the area of verbal behavior is a must, especially with respect to the acquisition of specific vocal motor control in infants. It is difficult for an experimenter to work with very young children, however, with the proper training a subject's primary caretaker could perform the pairing procedure. Another possibility is the use of experimental animals, specifically birds with the ability to imitate the human voice. This would eliminate the need for special training of child caretakers, scheduling, and other problems associated with the human subjects.
The results of the few studies conducted in this area to date point to a very useful concept and add further credibility to a scientific analysis of complex human behavior.
REFERENCE NOTES


Bandura, A. *Psychological modeling*. Chicago: Alden, 1971


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.